

# Electroconvulsive Therapy in the Medically Ill: When Should it be Considered?

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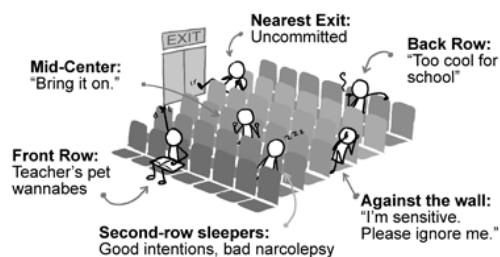
## Objectives

- Enhanced knowledge of the scientific literature published regarding the clinical efficacy and safety profile of Electroconvulsive Therapy (ECT) for depression.
- Review the physiological effects of ECT throughout the body.
- Enhanced knowledge of the literature regarding the use of ECT in medically ill populations.

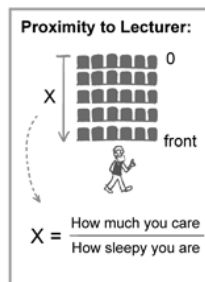
## Interactivity During the Lecture

### WHERE YOU SIT IN CLASS/SEMINAR

And what it says about you:



WWW.PHDCOMICS.COM

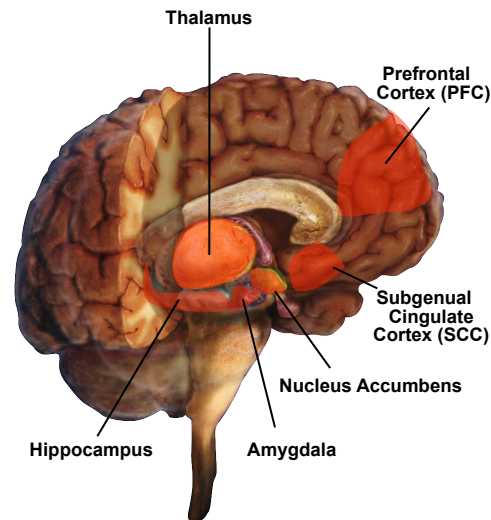


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## Electroconvulsive Therapy for Psychiatric Illness

## A Renaissance for Brain Stimulation?

- Recognition that the brain is an electrochemical organ
- More than 1 in 3 patients receive inadequate symptom relief from antidepressant medications
- The development of neurocircuitry models of the brain
- Advances in technology have provided multiple means of modulating activity in key structures in the brain



Giacobbe, Mayberg & Lozano. *Experimental Neurology* (2009) 219:44-52

## The Advent of the CANMAT Neurostimulation Guidelines

*Journal of Affective Disorders* 117 (2009) 544-553



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journal homepage: [www.elsevier.com/locate/jad](http://www.elsevier.com/locate/jad)



Research report

**Canadian Network for Mood and Anxiety Treatments (CANMAT) Clinical guidelines for the management of major depressive disorder in adults. IV. Neurostimulation therapies**

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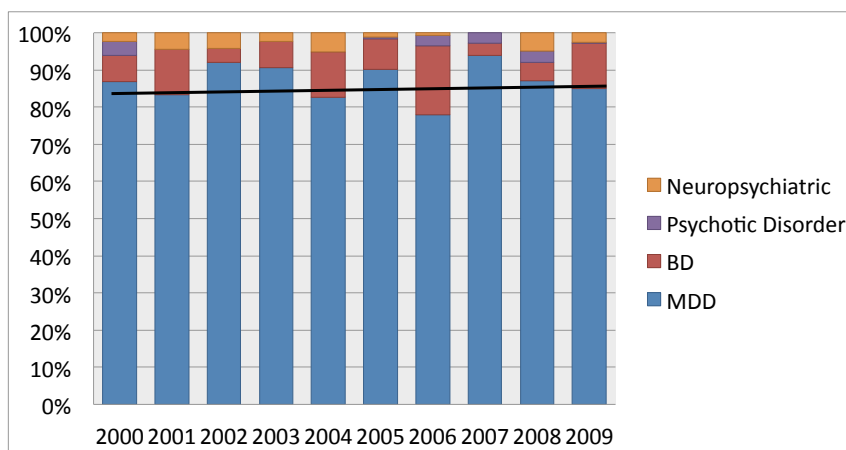
<sup>d</sup> University of British Columbia, Canada

## Diagnoses for Which ECT is Considered Effective

1. Major Depressive Disorder
  - Especially with psychotic features, catatonia, inanition and suicidal ideation
2. Bipolar Disorder (both depressed and manic phases)
3. Schizophrenia
4. Catatonia

From Fink. *Electroconvulsive Therapy: A Guide for Professionals & Their Patients*. (2009) Oxford University Press

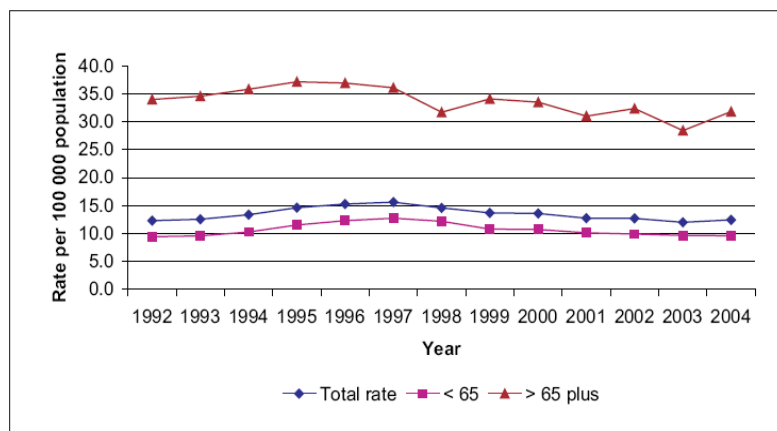
## Percentage of ECT Treatments by Diagnosis by Year at UHN



Linear Regression Equation =  $84.21 + 0.24x$  ( $p=0.67$ )

## Rates of Use of ECT in Ontario

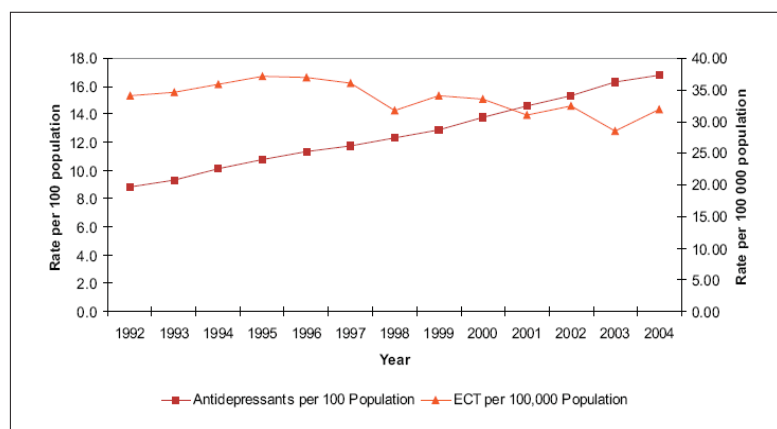
Figure 1 ECT rates in Ontario



from MJ Rapoport et al. *Can J Psychiatry* (2006) 51:616-9.

## Rates of Use of ECT in the Elderly

Figure 2 Prevalence of antidepressant and ECT use in Ontario's older adults



from MJ Rapoport et al. *Can J Psychiatry* (2006) 51:616-9.

## How Safe is ECT?

- The mortality rate has been estimated to be less than 1 death per 73 440 treatments.
- Similar to the background rate associated with anesthetic induction
- Serious complication rate of 0.53- 0.92%
- Lower overall mortality rate from natural causes in inpatients who have received ECT (RR=0.82, 95% CI 0.74-0.90)

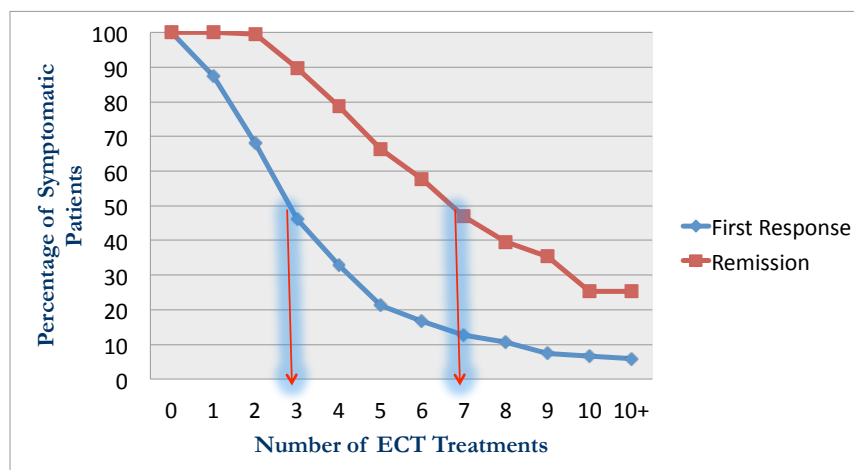


Nuttall et al. *The Journal of ECT* (2004) 20: 237-241  
 Munk-Olsen et al. *British Journal of Psychiatry* (2007) 190: 435-439  
 Watts et al. *The Journal of ECT* (2011) 27: 105-108.

## Meta-Analyses of the Antidepressant Properties of ECT

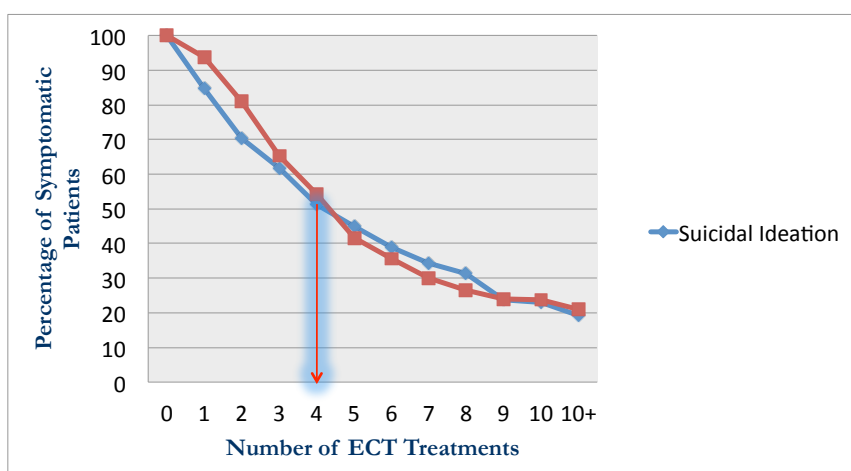
	Difference in HDRS Score (from UK ECT Review Group, 2003)	Odds Ratio of Response (from Pagnin et al., 2004)
<b>Real ECT</b> vs. Sham ECT or Placebo	9.7 (CI 5.7 - 13.5)	4.77 (CI 2.39 - 9.49)
<b>ECT</b> vs. Antidepressant Medications	5.2 (CI 1.4 - 8.9)	3.72 (CI 2.60 - 5.32)
<b>Bilateral</b> vs RUL Electrode Placement	3.6 (CI 2.2 – 5.2)	
One vs. Two vs. Three Treatments per week	No difference	
<b>High</b> vs. Low ECT Dosage	4.1 (CI 2.4–5.9)	

## Speed of Antidepressant Response With ECT



Adapted from Husain et al. *Journal of Clinical Psychiatry* (2004) 65: 485-91

## Rate of Relief of Suicidal Ideation With ECT



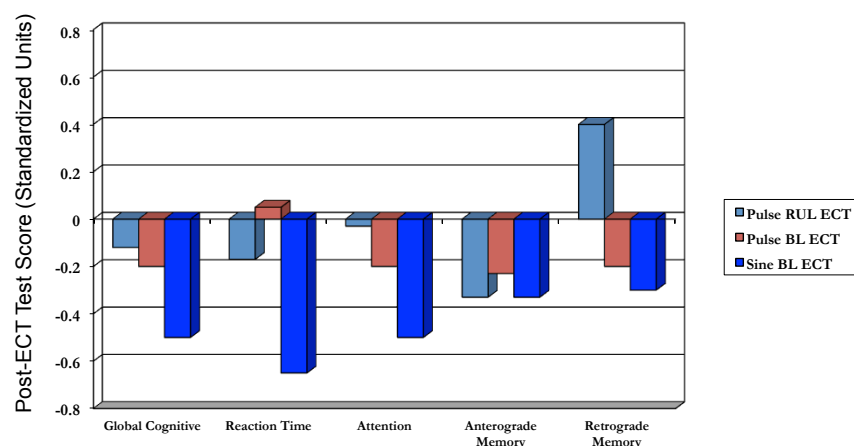
Adapted from Kellner et al. *American Journal of Psychiatry* (2005) 162:977-982 & al. *Journal of Clinical Psychiatry* (2004) 65: 485-91

Husain et

## Which Depressive Subtypes Are Responsive to ECT?

	Rates of Response	Reference
<b>Psychotic Depression</b>	<ul style="list-style-type: none"> <li>• Psychotic Depression (95%)</li> <li>• Non-Psychotic Depression (83%)</li> </ul>	Petrides et al. <i>Journal of ECT</i> (2001) 17: 244-253
<b>Atypical Depression</b>	<ul style="list-style-type: none"> <li>• Atypical (80.6%)</li> <li>• Typical (67.1%)</li> </ul>	Hussain et al. <i>Journal of Clinical Psychiatry</i> (2008) 69:406-411
<b>Bipolar Depression</b>	<ul style="list-style-type: none"> <li>• Bipolar (50%)</li> <li>• Unipolar (57.6%)</li> </ul>	Grunhaus et al. <i>Bipolar Disorders</i> (2002) 4 (Suppl. 1): 91-93
<b>With Comorbid Axis II Pathology</b>	<ul style="list-style-type: none"> <li>• No PD (65.3%)</li> <li>• Borderline PD (20%)</li> <li>• Other PD (52.4%)</li> </ul>	Feske et al. <i>American Journal of Psychiatry</i> (2004) 161: 2073-2080

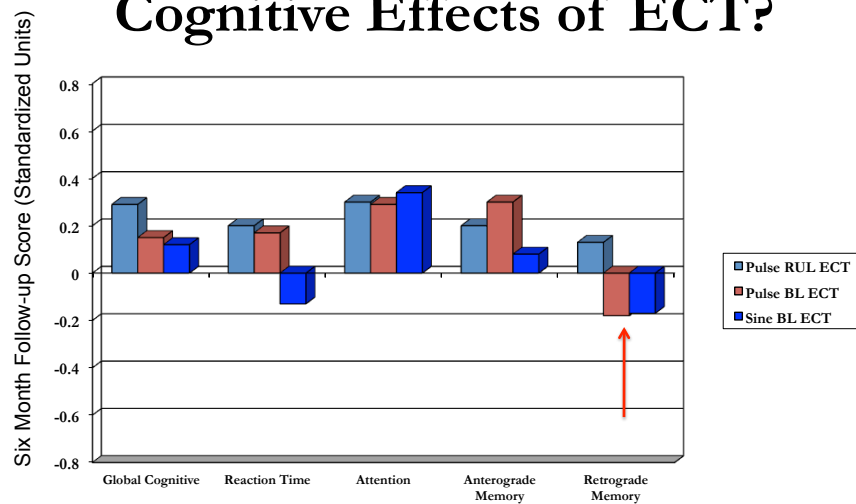
## What are the Immediate Cognitive Effects of ECT?



Adapted from Sackeim et al *Neuropsychopharmacology* (2007) 32: 244-254



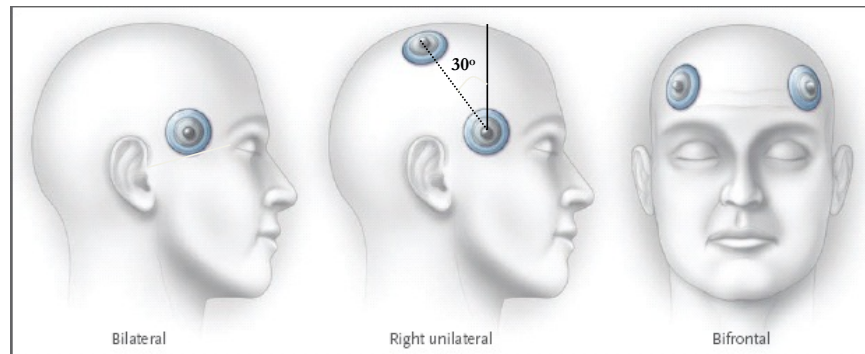
## What are the Longitudinal Cognitive Effects of ECT?



Adapted from Sackeim et al *Neuropsychopharmacology* (2007) 32: 244–254

## Physiological Effects of ECT

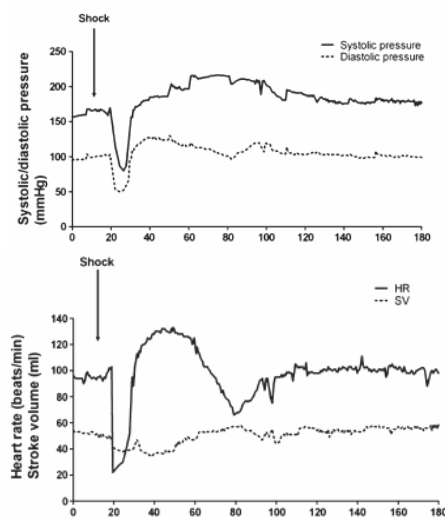
# Electroconvulsive Therapy



from Lisanby. *N Engl J Med* 2007;357:1939-45

## The Phases of an ECT Treatment

- Anesthesia
- Muscle relaxant
- The electrical stimulus
- Seizure
- Post-ictal recovery



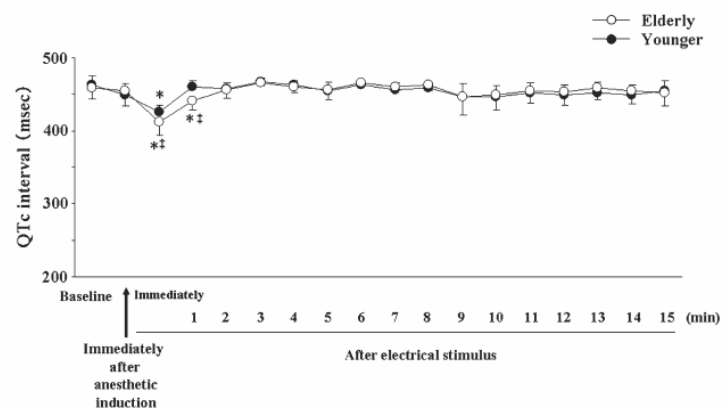
Geersing et al. *The Journal of ECT* (2011) 27:189-191

## Physiological Effects of ECT: The Cardiovascular System

- Similar to a brief period of “vigorous exercise”
- Electrical stimulus results in bradycardia and hypotension
- Seizure results in activation of sympathetic nervous system and catecholamine surge
  - Tachycardia, hypertension and increased myocardial oxygen demand



## ECT and the QTc Interval



Yamaguchi et al. *The Journal of ECT* (2011) 27:183-188

## ECT and Cardiac Disease

- ECT is considered a low-to-intermediate risk procedure according to the AHA
- ECT is associated with rapid, dramatic hemodynamic changes associated with Autonomic Nervous System activity
- Overall ECT-associated risk for cardiovascular complications is low but may be increased in vulnerable patients



**Kurup and Ostroff.** *International Anaesthesiology Clinics* (2012) 50: 128-140

## ECT and Cardiac Disease

- Reliable SBP increases of 29-48% and DBP increases of 24-60% during ECT
  - **Recommendation:** continue usual antihypertensives, IV labetalol for hypertensive reactions
- ECT is safe in patients with pacemakers or ICDs
  - **Recommendation:** turn off pacemaker and turn off detection mode of ICD
- ECT safe within 10 days of an MI
  - **Recommendation:** EKG and echocardiography for risk stratification
- Safe in AAA
  - **Recommendation:** adequate BP control, serial U/S to characterize size
- Safe in Atrial fibrillation
  - **Recommendation:** maintain INR up to 3.5, unless risk of intracranial hemorrhage

**Tess and Smetana.** *NEJM* (2009) 360: 1437-1444

## Physiological Effects of ECT: The Respiratory System

- Anesthetics blunt the ventilatory responses both to hypercapnia and hypoxemia
- Period of apnea during the ictal phase
- Exhalation against a closed airway results in a Valsalva maneuver
  - Return of systemic blood to the heart is impeded and the output of the heart is reduced



## ECT and Pulmonary Disease

- 4/34 patients requiring daily asthma medications daily had an exacerbation of their asthma
- 0% complication rate in 34 patients with COPD
- **Recommendations:**
  - Adequate pre-oxygenation
  - Avoid theophylline



Mueller et al. *Netherlands Journal of Medicine* (2006) 11: 417-421 &

Schak et al. *Psychosomatics* (2008) 49:208-211

## Physiological Effects of ECT: The Brain

- Cortical blood flow increases approximately 300% resulting in increases in ICP
- Cerebral oxygen demand increases approximately 200% during seizure activity



Patkar et al. *The Journal of ECT* (2000) 16: 189-197

## ECT and Intracranial Disease

- No cases of stroke in 2 large case series of 46,900 treatment sessions.
- Safe in patients with brain tumours and intracranial masses provided that there is not significant cerebral edema
- **Recommendation:**
  - Adequate BP control, neuroimaging, treat with dexamethasone if necessary

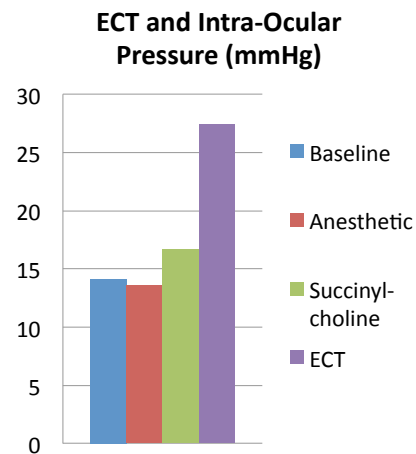


Patkar et al. *The Journal of ECT* (2000) 16: 189-197 &

Bruce et al. *The Journal of ECT* (2006) 22: 150-152

## Physiological Effects of ECT: The Eye

- Transient increase in intra-ocular pressure associated with ECT
- Returns to baseline within 2 minutes of the completion of the seizure



Adapted from Edwards et al *Convulsive Therapy* (1990) 6: 209-13

## ECT and Ophthalmological Disease

- Transient increases in intra-ocular pressure safe in patients with glaucoma and recent eye surgery
- **Recommendation:** Long-acting anticholinesterase eye drops should be avoided prior to ECT



Good et al. *The Journal of ECT* (2004) 20:48-49 &

Sienaert et al. *The Journal of ECT* (2013) 29:139-141



## Physiological Effects of ECT: The Gastrointestinal System

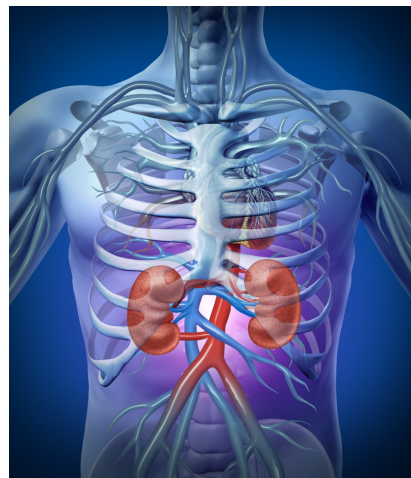
- Increased intra-abdominal pressure during the ictal phase.
- Case reports of bladder and gastric rupture in cases of inadequate muscle relaxation and non-NPO status.
- **Recommendation:**  
Administer Succinylcholine, NPO after midnight



van Schaik et al. *The Journal of ECT* (2006) 22: 153-154

## Physiological Effects of ECT: The Kidneys

- No change in creatinine levels post-ECT
- Succinylcholine results in an increase in  $K^+$  levels up to 0.5 mEq within 1 minute of administration
- Risk of cardiac arrhythmia with hyperkalemia



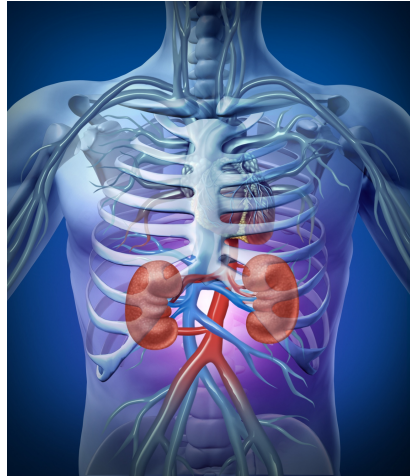
Bali. *British Journal of Anaesthesia* (1975) 47: 398-401 &

Ghanizadeh et al. *Neurochemistry International* (2012) 61:1007-1010



## ECT and Renal Disease

- Patients with MSK injuries and catatonia are especially at risk of hyperkalemia
- **Recommendations:**
  - Need to ensure that  $K^+$  is  $\leq 5.0$ - $6.0$  mEq in patients with chronic renal failure
  - Consideration can be given to rocuronium



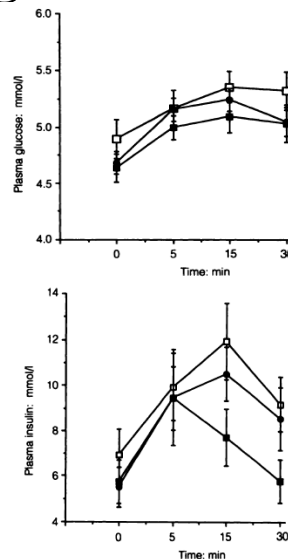
## Physiological Effects of ECT: The Musculoskeletal System

- Muscle relaxants minimize risk of fractures
- The most common adverse effects are myalgia (1/5) and headache (1/3).
- **Recommendations:**
  - BMD screening in women after the age of 70?
  - PRN acetaminophen or ibuprofen



## Physiological Effects of ECT: Blood Sugars

- There is a small but immediate increase in blood sugar and plasma insulin levels post-ECT
- Insulin responses attenuated over the course of ECT
- Return to baseline within 1-3 hours



from Williams et al. *British Journal of Psychiatry* (1992)  
161: 94-98.

## ECT in Patients with Diabetes

- 9% increase in blood sugar 20 minutes after ECT in 18 patients with Type 2 DM
- Same magnitude as seen in patients without DM
- No significant changes in insulin use post-ECT
- **Recommendation:** Blood sugar needs to be monitored pre-ECT +/- adjustments in hypoglycemic treatments



Netzel et al. *The Journal of ECT* (2002) 18:16-21 &  
Rasmussen et al. *The Journal of ECT* (2006) 22:124-126

## **When to Consider Electroconvulsive Therapy in the Medically Ill**

### **Electroconvulsive Therapy in the Medically Ill**

- There are no absolute contraindications
- 1. Is there a Psychiatric Indication?**
  - Individualized risk/benefit ratio of continuing medication/psychotherapeutic treatment of depression
- 2. What are the Medical Risk Factors?**
  - Complete history and physical
  - CBC, electrolytes, EKG, further investigations as needed
- 3. Can the Procedure be Modified to Minimize the Medical Risk Factors?**

# The Role of Brain Stimulation in the Treatment of Major Depression

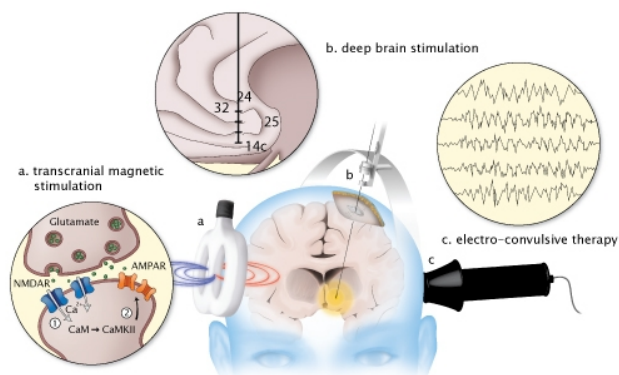
CMAJ

REVIEW

## Neuromodulation for treatment-refractory major depressive disorder

Nir Lipsman MD, Tejas Sankar MD, Jonathan Downar MD PhD, Sidney H. Kennedy MD, Andres M. Lozano MD PhD, Peter Giacobbe MD MSc

# The Role of Brain Stimulation in the Treatment of Major Depression



- Various treatments can be thought of as lying at various points of a spectrum of the degree of focality of stimulation provided to the brain and the invasiveness of the technique

## Summary of CANMAT Neurostimulation Guidelines

	Overall Recommendation	Acute Efficacy	Relapse Prevention	Safety and Tolerability
ECT	<b>First-line</b> for MDD with psychosis or suicidality  <b>Second-line</b> for treatment resistant or intolerant populations	Level 1	Level 1	Level 1
rTMS	Second-line	Level 1	Level 3	Level 1
DBS	Investigational	Level 3	Level 3	Level 3

Kennedy, Milev, Giacobbe et al. *J Affect Disord.* (2009) 117 Suppl 1:S44-53

## Conclusions

## ECT and Medical Illness

- With the modern technique, ECT is a safe procedure with an exceeding low mortality rate (same as risk of general anesthesia)
- The acute antidepressant properties of ECT remain unsurpassed
- ECT remains an underutilized tool in our armamentarium in 2013
- The physiological effects of ECT on multiple organ systems are well-characterized
- ECT is ideally administered in a general hospital setting

## Acknowledgements

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- Dr. N. Lipsman
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